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**Research Report**

## An update to estimates of human capital in New Zealand. Background paper to Te Tai Waiora: Wellbeing in Aotearoa New Zealand 2022

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TE TAI ŌHANGA  
THE TREASURY

# An update to estimates of human capital in New Zealand

Background Paper to Te Tai Waiora:  
Wellbeing in Aotearoa New Zealand 2022

Analytical paper 23/02

April 2023

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**ANALYTICAL PAPER 23/02  
BACKGROUND PAPER TO  
TE TAI WAIORA: WELLBEING IN  
AOTEAROA NEW ZEALAND 2022**

An update to estimates of human capital in New Zealand

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# Executive summary

Human capability is one of the four aspects of wealth in the Treasury’s Living Standards Framework. Combined with the other three aspects – the natural environment, physical and financial capital, and social cohesion, it underpins both current and future wellbeing.

Human capability is defined as “people’s knowledge, physical and mental health, including cultural capability”. It would be ideal if we could measure the total contribution to wellbeing of all of these aspects but, at the moment, there is no generally accepted methodology to do this, so it is not covered in this note. Instead, the methodology used widely in the literature measures only the labour market value of the knowledge portion, by looking at lifetime earnings associated with different levels of education. We have called this component “human capital” in this note.

Human capital is an important resource for the economy, enabling businesses to operate in a way that provides higher incomes. But it is equally important for an individual as not only do high levels of knowledge and skill increase their incomes, but they are also associated with many other positive outcomes in life. Treasury has previously written on the impact of human capability in lifting living standards in its Start of a Conversation series and this note is a continuation of this work (Morrissey, 2018).

The Treasury, as part of the first wellbeing report Te Tai Waiora Wellbeing Report 2022, commissioned Trinh Le, a leading New Zealand expert in this area, to update the valuation of New Zealand’s human capital previously published with co-authors John Gibson and Les Oxley in 2006 (Le et al, 2006). This short note is an introduction to the methodology, and it highlights some aspects of these numbers that were interesting. This work also provides, for the first time, disaggregated numbers for Māori and non-Māori human capital. An accompanying spreadsheet is provided with the detailed tables.

The key findings about the total value of New Zealand’s human capital are:

- The stock of human capital in New Zealand has risen 127% from \$858.9 billion in 1986 to \$1,948.4 billion in 2018 (in 2018 prices). This was significantly higher than the increase in the adult population over the same period, so human capital per capita increased by 48 per cent.
- The value of human capital is over double that of the physical capital stock as recorded in the System of National Accounts. This ratio has remained reasonably constant since 1986.
- Comparing New Zealand to other countries using the World Bank’s estimates of human and produced capital<sup>1</sup> for those countries suggests that New Zealand’s ratio of human capital to produced (buildings, roads, factories etc) capital stock is typical of high-income countries.

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<sup>1</sup> The World Bank’s definition of produced capital is slightly different to the System of National Accounts definition of physical capital. This note uses their metrics for the international comparisons and the New Zealand’s System of National Accounts metric for comparisons that are just within New Zealand.

- But the World Bank numbers for other countries also suggest our combined human and produced capital is low compared to other countries, though it has increased more rapidly since 1986.
- The key factors that explain the increase in human capital are changes in the age-profile of the population, the mix of qualifications and the percentage of the population that is in the labour force (known as the labour force participation rate).

The new human capital numbers are disaggregated both by gender and into Māori and non-Māori. The key findings from this disaggregation are:

- Female human capital has tracked persistently below male human capital largely because of lower female labour market participation. However, since 1986 the ratio of female to male human capital has lifted significantly (from 38% to 65%) as more women gained higher qualifications and as female labour market participation rate increased.
- Māori human capital has tracked below that of non-Māori, largely due to a smaller proportion of Māori with degree and higher qualifications and a lower Māori labour market participation rate, particularly for Māori men with low and mid-level qualifications. Māori and non-Māori human capital per capita have both increased since 1986 at a similar rate.
- Comparing the stock of Māori human capital with capital stock in the Māori economy shows that, as for New Zealand as whole, human capital is a significant contributor to the total wealth of the Māori community.

Our understanding of New Zealand's human capital would be improved if the current numbers were analysed further so that the relative importance of qualifications, labour market participation, age, gender, and their dynamic impacts, were more clearly understood.

But the greatest gain would be if a methodology could be developed to measure the non-labour market effect of human capital on wellbeing and economic performance. This would include both the effect of knowledge and skills in the other aspects of life, as well as the effect of physical and mental health and cultural capability for wellbeing and economic performance.

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# 1 Measuring the market value of knowledge and skills

Human capability is defined as “people’s knowledge, physical and mental health, including cultural capability” (Treasury, 2021, p. 16). It is one of the four aspects of wealth in the Treasury’s Living Standards Framework. Combined with the other three aspects – the natural environment, physical and financial capital, and social cohesion, it underpins both current and future wellbeing.

The Treasury, as part of the first wellbeing report Te Tai Waiora Wellbeing Report 2022, commissioned Trinh Le, a leading New Zealand expert in this area, to update the valuation of New Zealand’s human capital previously published with co-authors John Gibson and Les Oxley in 2006 (Le et al, 2006). This short note is an introduction to the methodology, and it highlights some aspects of these numbers that were interesting. This work also provides, for the first time, disaggregated numbers for Māori and non-Māori human capital. A spreadsheet is provided here with the detailed tables.

This section will cover the definitions used in this note, then it will describe the methodology used in the note, and its strengths and weaknesses. It will also provide information on the relative skill level of the adult population when this is measured directly. The following section will then provide the estimates of the wealth human capital creates which underpins current and future living standards.

Any assessment should cover all three aspects and their link to current and future wellbeing, but this report will largely focus more narrowly on the knowledge part of human capability and its relation to future labour market earnings, because this is where we have new estimates. We label this component of human capability as “human capital”, following the typical definition in the literature. In this report, all references to the value of human capital only include this narrower definition.

In this note we are using the term **human capability** to refer to the total value of people’s knowledge, physical and mental health, including cultural capability.

We are using the term **human capital** to refer to the subset of this represented by the labour market value of people’s human capability.

The focus on labour market income means this valuation misses other aspects of education that impact on overall wellbeing. This means it does not include the value of health to wellbeing, other than the benefit being healthy may make to labour market earnings. It also does not include all the value of education, including intangibles such as the joy of learning and the value that being knowledgeable and skilful has in other areas of life, including in volunteering and other forms of unpaid work. Currently there is no generally agreed methodology for capturing these. If we could measure them, the total valuation put on human capability would be much higher (Dasgupta, 2021, p.324). It is also likely that they would be more unequal as many of the non-labour market human capability outcomes are also correlated with qualifications, though this does not mean that these outcomes are caused by education. For instance:

- **Health:** 41% of those with no qualifications report excellent or very good health compared to 68% with bachelor’s degrees (Scott, Jan 2021).

- **Political efficacy:** 52% with no qualifications agreed that “people like me don’t have any say in what the government does” compared to 26% with degrees (Satherley, March 2022).
- **Volunteering:** 41% with no qualifications volunteer at least once a month compared to 56% of people with degrees (Satherley, Sept 2022) .
- **Social trust:** 77% with no qualifications agreed that “there are only a few people you can trust completely” compared to 56% with degrees (Satherley, Dec 2021).

This means that this paper is taking a high-level, market-based view of the role of human capital, as an input in the benefits of education for the labour market, and through that for the wider economy. It also reflects the value for the individual, but it is not a particularly appropriate methodology for considering the possible reasons for specific differences in outcomes, such as gender or ethnicity gaps. Understanding these requires data for individuals rather than aggregate groups, and more detailed information of how these outcomes develop over the life course and over generations.

## The methodology used in this valuation

The estimates of New Zealand’s human capital discussed here are based on the knowledge and skills of the population uses. It uses one of three accepted methodologies to value people’s knowledge and skills using the projected earnings profile for each level of education based on the level of labour market engagement and the incomes earned by older people with this level of education.<sup>2</sup> This assumes a person’s future earnings will follow a path that is predicted by the current average age profile of earnings. This may or may not be the case depending on such factors as changes in the economy, labour market participation choices and technology. However, this has been the most popular approach in recent years, and most high-income countries now estimate the value of their human capital stock in this way.

The estimates use the specific methodology developed by Le et al, (2006) to value human capital based on New Zealand census data covering 1981 to 2001. In non-technical terms, the estimates are created by assuming that a person of a particular gender, ethnicity and qualification level will receive future earnings at each age that are the same as the average received currently by people of the same gender, ethnicity and qualification level at each age, adjusting for expected growth in economy-wide average earnings. This projected income profile is then converted into the sum of money that would earn that amount if it was invested at 6% per annum for the number of years of expected working life remaining at each age.

The Treasury commissioned Trinh Le to update these numbers to provide a consistent time series for each census from 1986 to 2018.<sup>3</sup> To be internationally comparable, Le follows the international practice of only including income earned from the ages of 18 to 64.

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<sup>2</sup> The other two methodologies are measuring the costs of creating skills, (which is inadequate as the costs and the value of the skills can be totally different) and a set of indicators (which provides trends in different aspects like levels of qualification or years of schooling but does not calculate the overall quantity of that human capability is a resource pool available to support individuals, firms, and society). A fuller discussion of these approaches can be found at (Abraham and Mallat, 2022)

<sup>3</sup> The 1981 census data was collected using categories that were less compatible with subsequent years, so we did not include it in this time series.



## The strengths and weaknesses of this approach

The methodology used has some strengths and some weaknesses. It is unclear whether these lead to an over- or under-valuation overall of human capital. The strengths are:

- It is a widely used approach including by the World Bank. This means that we can compare our results with other countries.<sup>4</sup>
- It implicitly captures personal attributes that impact on income through education and the additional skills from experience and learning on the job.
- It also captures the factors that impact on the ability to use knowledge and skills, such as the level of access to appropriate capital equipment and workplace organisation as these aspects will affect the wages earned. Research shows these factors are why the income earned by people with identical skills varies from country to country, region to region, or even between firms in the same region (Deming, 2022, pp.78-79).
- The values are comparable to the net capital stock in the System of National Accounts, in the sense that both are measured in dollar terms.

On the other hand, the approach has some weaknesses. These are:

- It assumes qualification rates and labour market participation rates at each age remain the same as current rates.
- It assumes that returns to qualifications are stable through time.
- It focuses on “knowledge” skills embedded in qualifications rather than “higher order” skills like patience, self-control, the ability to work as part of a team, and problem-solving. These are increasingly important in the labour market. Any change in the balance between knowledge skills and higher-order skills will not be reflected in the valuation.

Before outlining the human capital metrics, the following sections provide some additional context about each of these weaknesses and how they may bias the final measures.

### Qualification rates and labour market participation rates

The methodology effectively assumes that current labour market participation rates and educational achievement patterns continue. This means it captures current enrolment patterns by young people, but it does not allow for any future changes in enrolment patterns. Similarly, it assumes current labour market participation rates continue, but there is no future lift in rates. It also assumes that the current relationship between qualifications and future earnings continue. But there has been a long-term trend for people to gain higher qualifications and for women particularly to increase their labour market participation. As will be discussed further below, this has added materially to the estimated value of human capital in New Zealand over time. However, it also does not reflect any possibility that the current concerns with declining school level skills may reduce the skill mix in the future (The Treasury, 2022).

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<sup>4</sup> There are small methodological differences across the different metrics, but the inherent approach is the same.

The methodology also uses current labour market participation rates, even though rising female participation rates have increased the estimated value of female human capital significantly in recent decades. As New Zealand's rates are currently very high compared to other OECD countries, it is less likely that there will be as significant a lift in rates in the future. The other issue is that the standard working age assumption of retiring at age 65 does not fit well with New Zealand's working patterns. In 2021 a quarter of those over the age of 65 were still working (Statistics New Zealand, 2022). This means that the valuation for New Zealand will be conservative compared to countries, where working over the age of 65 is less common.

### **“Knowledge” skills rather than “higher-order” skills**

Over the last few decades “higher order” skills (like patience, self-control, the ability to work as part of a team, and problem-solving) have increased in importance. For instance, in the United States the labour market value of a young person's social skills has doubled between the 1980s and the 2000s. But while these skills have a marked impact on life outcomes,<sup>5</sup> efforts to teach these skills have had mixed success (Deming, 2022, p. 91). While there is some evidence that “higher order” skills are correlated with educational attainment, largely because they also help people with their studies, qualifications are not a perfect predictor of them.

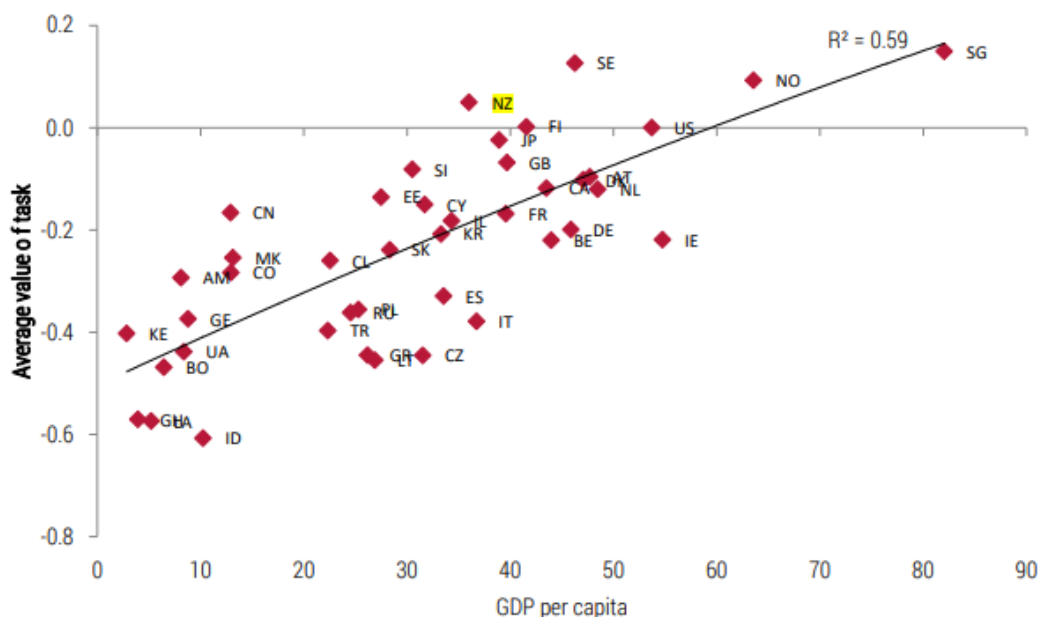
Jobs in high-income countries have increasingly required problem-solving and personal skills. New Zealand's labour market has followed this trend, particularly due to the growth of the service sector where 70 percent of workers are now employed. A recent study estimated the task content of jobs in different countries. As Figure 1 shows, they found that New Zealand's profile of occupations implied that we have one of the highest levels of non-routine cognitive personal skills of the many countries included in the study. The study also found that problem-solving and teamwork are particularly valued in high-income services, particularly in areas like computing (Hardy et al, 2018).

Because the methodology used in the calculations of human capital uses qualifications to predict the likely path of labour market earnings, it will not anticipate any changes in labour market earnings due to the increased labour market value of these higher order skills.

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<sup>5</sup> The impacts of patience and self-control were famously studied in the “marshmallow test”.

**Figure 1: The average value of non-routine cognitive personal skills in the tasks performed in the labour market**



Source: Hardy et al, 2018, Figure 2

## Labour market outcomes compared to skill levels

The methodology is not a direct measure of the capability that is embedded in the adult population. Rather it is looking at what that capability enables a person to earn. This means it is not a measure of the stock of human knowledge, but rather a measure of how effectively this stock can be used in the New Zealand economy. The value of knowledge in the labour market depends not just on their skill level, but also on the structure of the economy, whether the skills match what employers need and whether workers have access to the appropriate capital stock and industrial organisation to maximise the usefulness of their human knowledge.

This means our measures of human capital are affected by the fact that, compared to many other OECD countries, our average wage is lower and the difference between returns to higher qualifications and no qualifications is smaller. The wage rate differences mean that the valuation of our human capital is lower than in many countries even though our measured skill levels are very high. This may be because the small size of our economy limits the level of specialisation or the gains from economies of scale, or it may be because of matching issues, where the jobs people hold do not fully utilise their skills. There is no evidence to suggest that the reason for the difference is that our qualifications contain lower skills than the same qualification overseas. In fact, when skill levels are measured directly, they are high compared to other countries, particularly school qualifications. While the reason for our low return to skills is not clear, it has been a feature of the New Zealand economy since at least the 1960s.

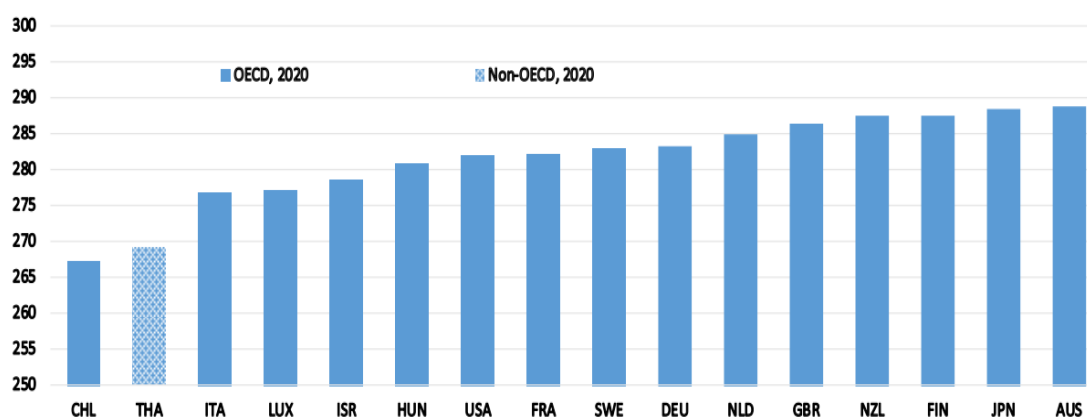
## New Zealand's stock of adult skills compared to other countries

Using qualifications as a measure of skill is reasonable on an aggregate basis, even if it does not necessarily accurately predict the skill level of a particular person. The OECD's Programme for the International Assessment of Adult Competencies (PIAAC) tested a random sample of New Zealand adults using a mini exam to measure their skills. On average those with no qualifications had the lowest skills while those with bachelor's and post-graduate qualifications had the highest (for instance, 36% higher for literacy). But there was relatively little difference in the skill level between people with higher school qualifications (NCEA 2 and 3) and those with sub-degree-level tertiary qualifications (Ministry of Education, 2016). For the valuation below, these two groups have been combined into a "mid-skill" group.

The OECD also uses a mini exam in the Programme for International Student Assessment (PISA) to test the skills of 15-year-olds. Recently the OECD has used the two direct measures of skill levels to develop a new approach to estimating the relative quantity of adult skills. This gives an index estimating the relative quantity of adult skills, but, unlike the approach used in this report, it does not then estimate the economic value created by that stock (Égert et al, 2022).

This is a new methodology and is probably the most direct way of measuring skill levels for cross-country comparisons, as the skills embedded in qualifications are known to vary between countries.<sup>6</sup> New Zealand has a very high level of skills and knowledge compared to most OECD countries.

**Figure 2: New Zealand in the OECD's new measure of the stock of human capital**



Source: Égert et al, 2022, Figure 4a

<sup>6</sup> This has been one of the criticisms of using years of schooling as a metric. What is learned in a year of school varies significantly between countries, especially between low- and high-income countries.

The OECD analysed the implications of its new measure and found:

- National skill levels measured at age 15 were very predictive of the future adult skill levels measured in PIAAC surveys decades later, though this may not be the case for New Zealand because of our high level of immigration. However, it does suggest that for the New Zealand-born population, our declining PISA performance for 15-year-olds over the last two decades is predictive of lower skills in the future (The Treasury, 2022).
- The new OECD metric was robustly correlated with productivity, both across time for individual countries and between countries.
- Improving the *quality* of skills lifted productivity far more than lifting *quantity*. The OECD found higher PISA test scores had significantly more impact on productivity than people spending longer in education. This suggests that just keeping young people in education will not improve productivity unless the extra time is used to build additional skills (Égert et al, 2022).
- In the long run, the OECD conclusion from their cross-country study was that improving PISA scores may have as much effect on productivity as improving the level of competition in the marketplace, which is regarded as a major productivity-enhancing policy. While this is an average looking across different countries, the skill-intensive structure of the New Zealand economy may mean it is true here. However, the lag is very long, so our declining PISA scores may currently be having little impact on our productivity rate.

## 2 Valuing New Zealand's human capital

This section discusses the new estimates of the labour market returns to New Zealand's human capital using the incomes that are earned in the labour market as an indicator of how the skills in the population support living standards. It then puts these estimates in context by comparing them to the value of physical capital in the National Accounts (the depreciated value of all the fixed assets, such as buildings, vehicles, machinery, and roads) and by presenting some international comparisons.

In 2006, New Zealand's human capital was valued using labour market incomes (Le et al, 2006). To support our work for Te Tai Waiora: Wellbeing in Aotearoa New Zealand 2022, Treasury commissioned the lead author, Trinh Le, to update the figures for subsequent censuses so that we had a consistent series across time. The detailed tables and the methodology can be found in her background report (Le, 2022).

The Treasury also commissioned a separate estimate of the value of Māori human capital using the same methodology. The definition of Māori at each census is included in the background report, but the key point is that people are identified as Māori if they meet the widest possible criteria of either self-identifying as Māori or have Māori ancestry, and even if they indicated other ethnicities as well.

### Calculating human capital

Census data is used to calculate the average income earned by people divided into groups based on their age, gender, and education level. This is then projected forward for people currently in the labour force and discounted to present value terms using a 6 percent rate to give the capital sum.

The capital sum can be thought about as the amount of money which invested at 6 percent would provide that same income stream as the earnings over the years that remain until a person reaches 65. The discount rate is used because earnings today can immediately improve wellbeing, while future earnings have lower impact.

### The estimated value of human capital

The estimated value of New Zealand's human capital stock in 2018 was \$1,948.4 billion. In the 32 years since 1986, the real stock of human capital (that is, after allowing for inflation) grew at 2.6 percent per annum and, as a result, it has more than doubled.

There has been some variation in the rate of growth over time, with higher growth in the early 1990s and for most of the 2000s. The highest growth rate was in the final five years of the series. In part this was due to high population growth. The value of the human capital stock for each person in the total population (including children and those over the age of 65) also increased most rapidly since 2000, but its growth rate is lower.

**Table 1: Aggregate value of human capital stock, 1986 to 2018**

(2018 billion dollars)

Qualification level	1986	1991	1996	2001	2006	2013	2018	% of labour force <sup>3</sup>
Low <sup>1</sup>	341.7	281.0	322.0	362.9	366.9	356.5	375.4	31.1%
Mid-level <sup>2</sup>	412.1	476.4	516.5	525.0	619.9	689.2	820.0	41.7%
Bachelors	64.6	87.2	126.9	168.4	260.3	356.4	418.2	16.1%
Postgraduate	40.5	47.4	67.3	85.1	119.4	187.1	335.0	11.0%
<b>Total</b>	<b>858.9</b>	<b>891.9</b>	<b>1032.8</b>	<b>1141.5</b>	<b>1366.4</b>	<b>1589.3</b>	<b>1948.4</b>	<b>100%</b>
Growth rate p.a.		0.8%	3.0%	2.0%	3.7%	2.2%	4.2%	
<b>Human capital per capita (\$000s, total population)</b>	<b>264.6</b>	<b>255.7</b>	<b>277.4</b>	<b>294.5</b>	<b>327.2</b>	<b>358.3</b>	<b>398.8</b>	
Growth rate p.a.		-0.7%	1.6%	1.2%	2.1%	1.3%	2.2%	

1 No qualifications and NCEA Level 1 or equivalent.

2 NCEA 2,3 and post-school non-degree qualifications.

3 Working age population aged 18-64.

Source: Le (2022)

## New Zealand's human capital valuation in context

The valuation of \$1,948.4 billion requires context to be understood and one context is to compare it with the stock of physical capital in the National Accounts and with GDP. Since 1986, New Zealand's stock of human capital has been consistently more than double the value of physical capital<sup>7</sup> recorded in the national accounts, and the ratio has been generally stable, although it was a little lower in the early 2000s. There has also been a reasonably constant relationship between human capital and GDP. Over the whole period, human capital has been about 6.5 times the level of annual GDP, although it was again a little lower in the early 2000s.

**Table 2: New Zealand's human and physical capital stocks, 1986 to 2013**

(\$billions 2009/10 prices)

	1986	1991	1996	2001	2006	2013	2018
Human capital	\$858.9	\$892.0	\$1032.8	\$1141.5	\$1366.5	\$1589.3	\$1948.4
Capital stock	\$389.9	\$443.5	\$478.1	\$540.5	\$636.2	\$735.2	\$844.4
Human/physical	2.20	2.01	2.16	2.11	2.15	2.16	2.31
Human capital/GDP	6.7	6.7	6.6	6.3	6.2	6.5	6.7

Source: Human capital from Table 1. Physical capital from Statistics New Zealand, Net capital stock SNE064AA. Real GDP SNE038AA rebased to 2018/19 dollars

It is not surprising to find that human capital is large compared to the stock of physical capital. New Zealand is now a service sector economy and some of the key service industries (but not all) use relatively little physical capital but require high levels of human capital and intangible assets.<sup>8</sup>

<sup>7</sup> This is the stock of built capital included in the System of National Accounts (SNA), so it does not include natural or social capitals.

<sup>8</sup> Further discussion of this trend and its implications can be found at (Janssen, J, 2022).

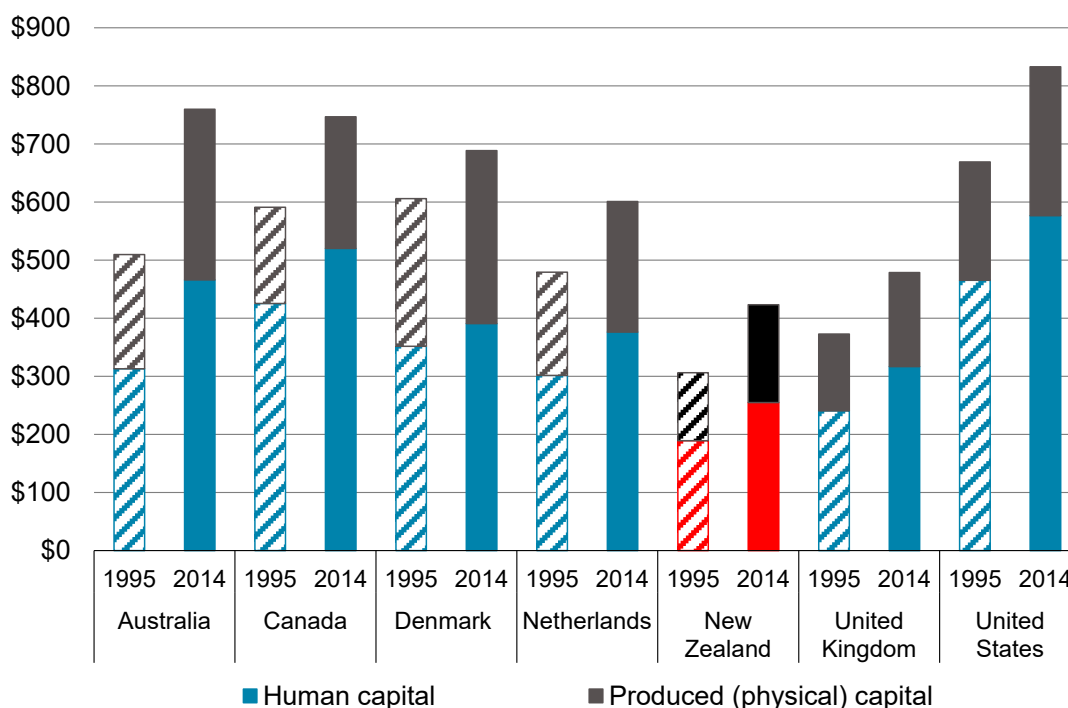
Le’s methodology is essentially the same as that used by the World Bank in its report on the Changing Wealth of Nations. This means we can use this estimate in conjunction with the World Bank’s numbers on produced capital to compare to other similar countries.<sup>9</sup>

In contrast to the OECD metric reported earlier which was based on direct measurement of skills, as Figure 3 shows, the World Bank metric shows that human capital is low in New Zealand, which reflects that the incomes earned by highly skilled New Zealanders are comparatively low. The combined level of the human and physical capital per person is also relatively low compared to similar countries. This suggests that we have not been compensating for lower human capital by investing in physical capital. Only the United Kingdom has a similar (though still higher) combined capital stock. The other countries have significantly higher total capital. In the case of Australia and the United States, the level is about double that of New Zealand.

However, since 1995, New Zealand growth in its combined human and net physical capital has been fast compared to these other countries. Our total of the two types of capital increased by 38 percent between 1995 and 2014 and only Australia had a larger percentage increase (49 percent). By contrast, the countries that began with higher levels of combined capital have generally increased their capital by significantly less.

**Figure 3: New Zealand’s human and physical capital is low but growing rapidly**

Per capita, \$2018



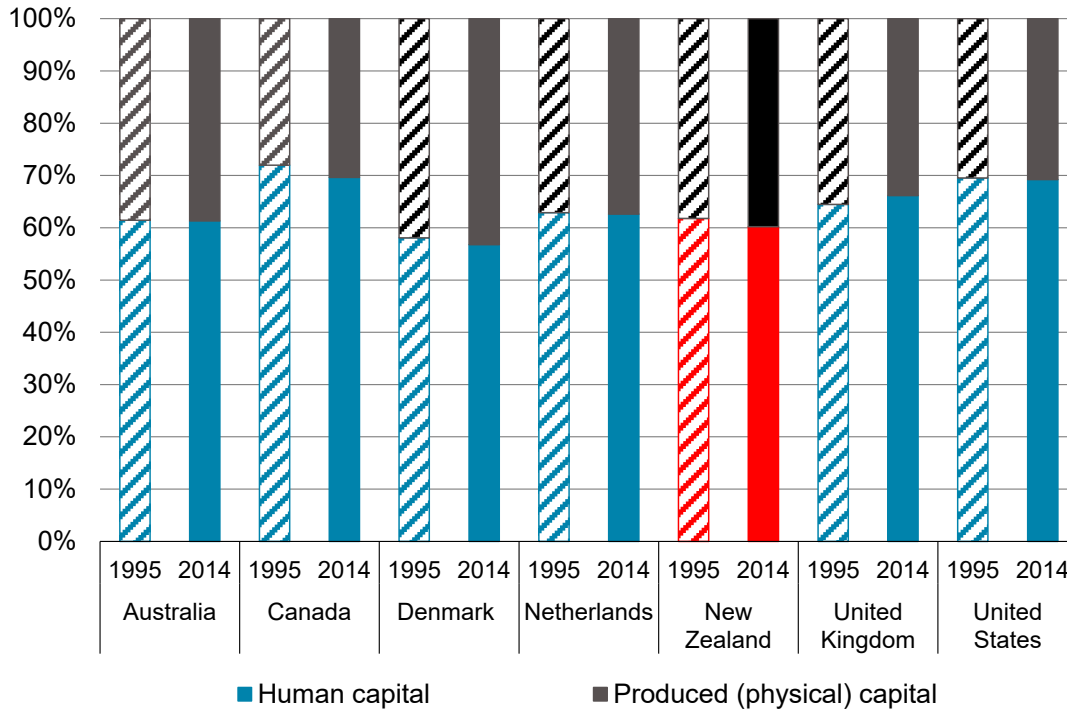
Source: World Bank (2021) with New Zealand’s human capital from Le (2022)

<sup>9</sup> The World Bank did not estimate New Zealand’s human capital stock but did estimate the produced and natural capital. As there are issues with the natural capital stock measures, we have only used the produced one in this report. For further information on the issues with the natural capital estimate, see (The Treasury, 2022a, Appendix A).



On the other hand, New Zealand's split between human and physical capital is like the other countries in this comparison. As Figure 4 shows, while there are minor variations in these countries typically human capital is more than half of the value of the combined produced and human capital, and typically it is in the 60 to 70 percent range.

**Figure 4: Comparing New Zealand's produced and human capital mix**



Source: World Bank (2021) with New Zealand's human capital from Le (2022)

### 3 Underlying factors behind the results

This section discusses the key factors that impact on the level of human capital both in total and between people. It provides some additional information about the trends for these key factors which are an important context for the following section which looks at the differences by gender and between Māori and non-Māori.

The new estimate of human capital is disaggregated by gender, and, for the first time, we also have estimates for Māori and non-Māori. The human capital for each of these subgroups at each point in time depends on projected lifetime earnings at that point for people in the group as a whole.

Differences in earnings between these subgroups can be driven by a number of factors. The census data does not allow us to assess all of them, but we can observe some of them, notably:

- Earnings in general vary by qualification level, so differences in the qualification mix will lead to differences between the groups.
- The value of human capital also varies with age. The major driver of this is the fact that those who are young have the potential to earn for many more years than those who are older, but it also reflects the fact that experience increases skill levels.
- The value also varies with labour market participation, so if there are differences in the number of years that people are in the workforce, that will be reflected in the value of human capital. This aspect, more than any other, highlights the missing non-labour market value of human capability as many of those not in the workforce may be engaged in activities with significant (if not paid) value for wellbeing such as childcare.

#### The role of qualifications

A recent review of the international literature synthesised four stylised facts on the knowledge and skills part of human capital<sup>10</sup> from an enormous volume of available research (Deming, 2022). It found that the level of knowledge and skills explains a substantial share of the variation in labour earnings within and across countries. This is especially so when it is measured using actual skills (through testing people, like happened with the PIAAC study) rather than qualifications. For instance, the reviewers found that the level of knowledge and skills explained about one-third of the variation in earnings in the USA and between 50% and 70% of the cross-country income differences (p.82).

While there are variations by the **subject** studied, New Zealand research shows that the qualification **level** has the bigger impact on earnings. For instance, there is only a small difference between science-focused graduates and non-science-focused graduates with either sub-degree or degree and above qualifications but there is a major difference between sub-degree and degree and above in both subject areas (Maré et al, 2017, p.18 Figure 3b).

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<sup>10</sup> The authors use the term “human capital” to mean the skills and knowledge portion of human capability.

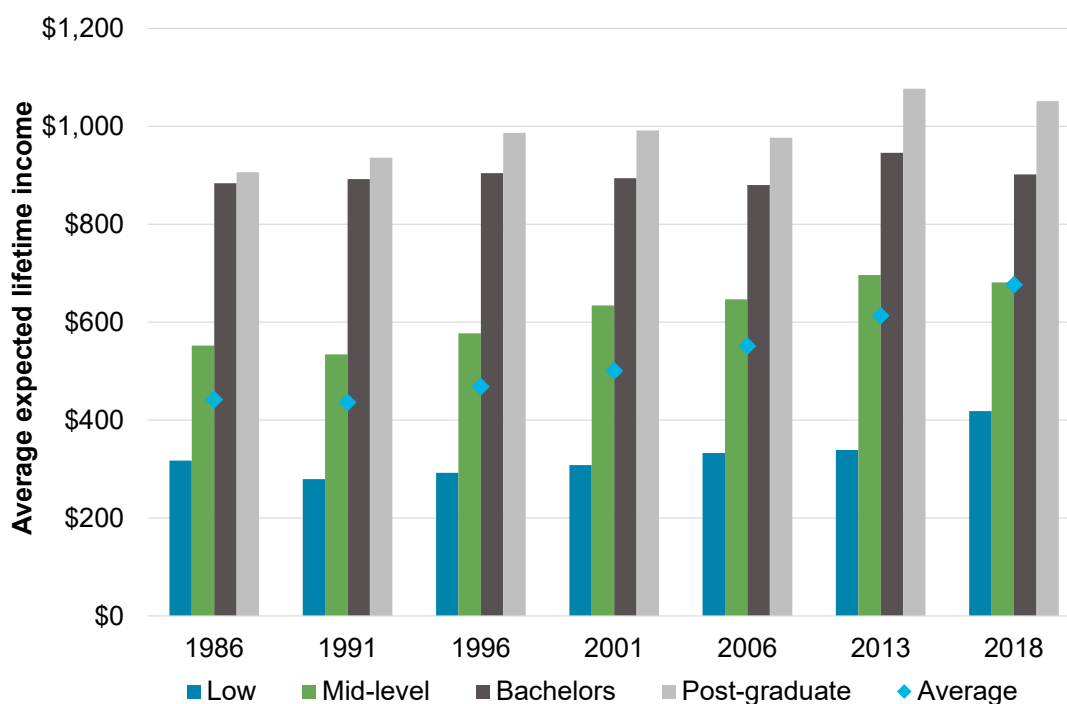
The human capital calculations split the population into four qualification groups:

- **Low** qualifications, below NCEA level 2, including no formal qualifications.
- **Mid-level** qualifications, NCEA 2 and 3 and sub-degree qualifications.
- **Bachelors** qualifications.
- **Post-graduate** qualifications, through advanced training mainly at universities.

Figure 5 shows the expected accumulated lifetime income for each qualification group adjusted for inflation to 2018 dollars. There is a significant difference by qualification level, with bachelors or higher degrees expected to earn at least twice, and in some years nearer three times, the lifetime income of a person with low qualifications. This pattern has been persistent over the last three decades, though there has been some real income growth for all the qualification groups except for those with bachelors' degrees. This growth has been largest and most persistent for those with mid-level and post-graduate qualifications. Despite these changes the difference in earnings between qualification levels remains low in New Zealand compared to many other countries.

**Figure 5: Average expected lifetime earnings by qualification level, 1986 to 2018**

\$2018 thousand, real per capita

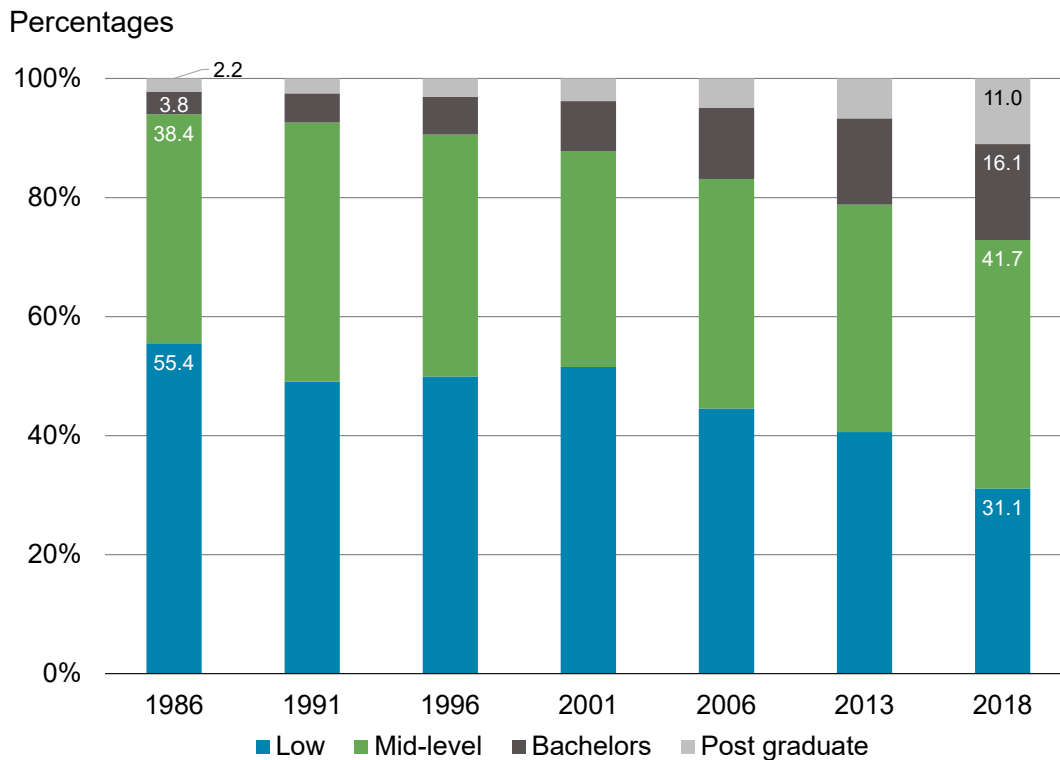


Source: Le, 2022

The graph also shows the average value of expected lifetime earnings across all four qualification groups. This has lifted from being half of the degree level lifetime earnings in 1986 to over three-quarters in 2018. This upwards movement in the average has persisted in each year since 1991 and, if anything, it has been accelerating. Between 1991 and 2001 the average lifetime earnings rose by 1.4 percent per annum while between 2001 and 2018 it was at 1.8 percent per annum.

This reflects a significant change in the adult qualification mix. In 1986 over half of 18- to 64-year-olds were in the low qualifications group (with many having no qualifications) while in 2018 less than a third were in this group. At the same time, the proportion with bachelor and post-graduate qualifications rose from 6 percent in 1986 to 27 percent in 2018. However, the lifetime earnings for this group remained the same or rose in real terms, suggesting that the labour market was able to absorb the extra supply. In the most recent years the median wage for all qualifications groups has been growing more slowly than for those with no qualifications, possibly because of movements in the minimum wage.

**Figure 6: The distribution of qualifications in the 18- to 64-year-old age-group**



Source: Le (2022)

The rising qualification levels in recent years is part of a much longer trend that has been experienced over the twentieth century by both New Zealand and most other countries in the world. In New Zealand it has both been driven by, and enabled, the New Zealand economy to move labour out of low-skilled occupations, many of which were in agriculture and industry, and into skilled occupations, many of which are in the service sector.

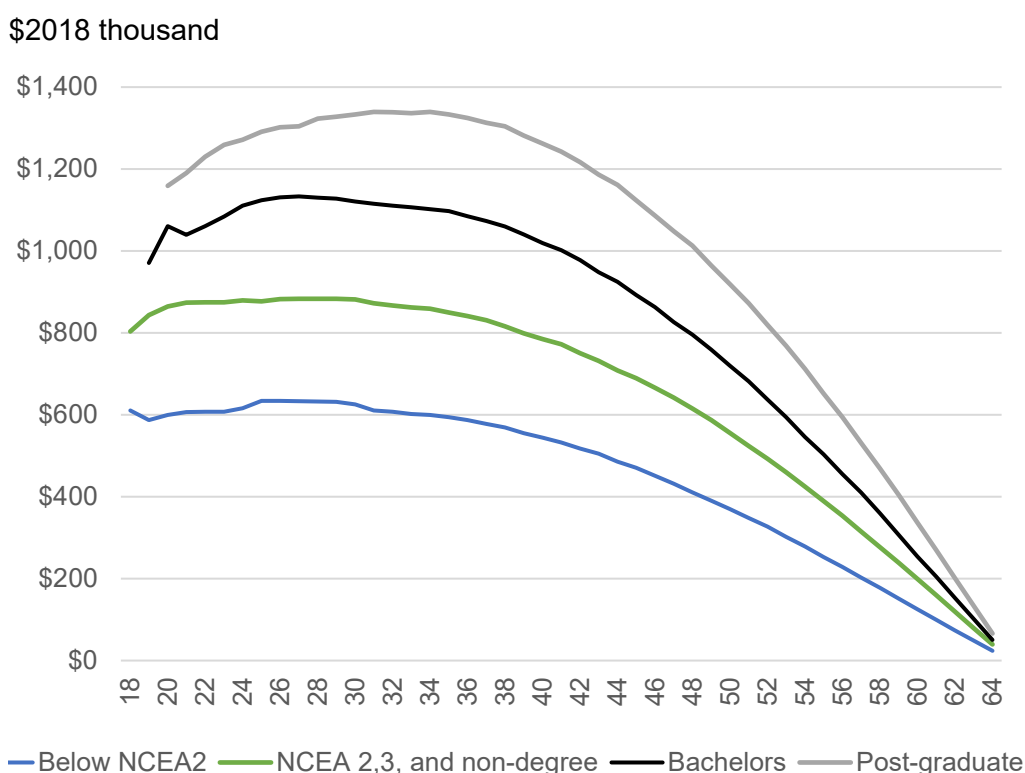
While this has been an international trend, New Zealand experienced a particularly rapid and early shift towards higher skilled jobs in the 1990s and 2000s. New Zealand also were early in “moving up the value chain” through embedding value from the service sector into our agricultural and manufactured exports. In 2018 a quarter of the value-added in our primary sector and industrial exports was from the service sector (Janssen, 2022, p.21).

## The role of age and the life cycle

Because the valuation of human capital is the discounted sum of the expected stream of earnings that a person will receive over the balance of their working life to age 64, it is highest when a person is young enough to have still many years working, while old enough to have accumulated knowledge and skills. As people age, they have fewer years of earning before they reach 65. This means the remaining value of their future earnings declines.

The age profile varies between the different qualification levels. Those with higher qualifications have a much higher peak value for their human capital when they are in the early years of their working life, but they experience a faster decline as retirement approaches. At its peak, when people are in their early 30s, those with post-graduate qualifications have a future income stream that is equivalent to more than \$1.3 million compared to a little over \$0.6 million for those with low qualifications (in 2018 real dollars).<sup>11</sup>

**Figure 7: Average human capital per capita value by qualification level, 2018**



Source: Le (2022)

The impact of education is higher if people get their higher qualifications early in life, as this means it will support more years of higher earnings. The evidence also suggests that those who are more highly educated get more opportunities for further formal and informal training once they are working. People also gain labour market valuable skills from their experiences in the workforce and their other life experiences. The overall value of this additional training and informal skills is apparent in the fact that even after most people complete full-time education, their earnings continue to grow.

<sup>11</sup> The trends do not take into account any changes in the characteristics of the groups over time such as changes in demographics.

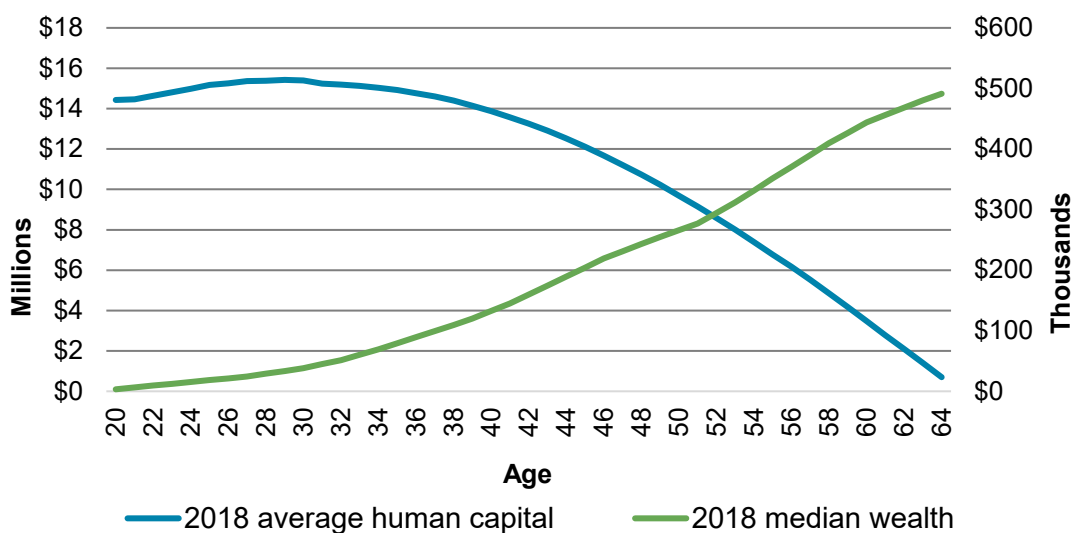
In 2014, New Zealand workers reported that they experienced one of the highest levels of on-the-job training in the OECD, and this was true of both formal and informal training. But this survey also found that those with higher qualifications were more likely to have access to training opportunities than those with low qualifications. This is a common pattern internationally and, if anything, New Zealand had more training for low skilled workers than most countries (Ministry of Education and Ministry of Business, Innovation & Employment, 2016, pp.19-22).

People with degree and post-graduate qualifications experience a larger and longer increase in human capital in their twenties and early thirties. This has had the effect that as the proportion of these qualifications in the population increased, the average age at which the value of human capital peaked increased. In 1986 peak human capital was reached at aged 25; in 1996 it was at 27; and by 2018 the value peaked at age 29.

The pattern of human capital over a person’s lifetime is very different to the pattern for physical/financial capital, as shown by their wealth. Human capital is measured as the expected earnings in the future. On the other hand, wealth is the accumulation of assets after people have used their income to live. Because these concepts are so different, the levels of the two measures cannot be directly compared. But it is reasonable to compare their trajectories over the life course.

Over their lifetime people turn their human capital into an income stream and many of them then use a portion of this to build physical and financial wealth. This does not happen quickly because wealth is built after living costs, so average wealth does not really start to accumulate until people are over the age of 40. Focusing only on financial/physical wealth understates the total capital that young people have in their future while overstating the resources available for the future wellbeing of older people.

**Figure 8: The pattern of the value of human and monetary wealth over the life cycle**



Note: These two measures are based on different concepts which means they cannot be compared in terms of levels. However, their trends can be compared.

Source: Le (2022) and Statistics New Zealand Household Economic Survey 2017/18

## The role of labour market participation

Labour market participation varies with qualification level, gender, and ethnicity. The impact on the measures of human capital by gender and ethnicity will be discussed further below, but the impact of variations by qualification level on labour market participation rates is shown in Figure 9. This pattern has been stable since 1986.

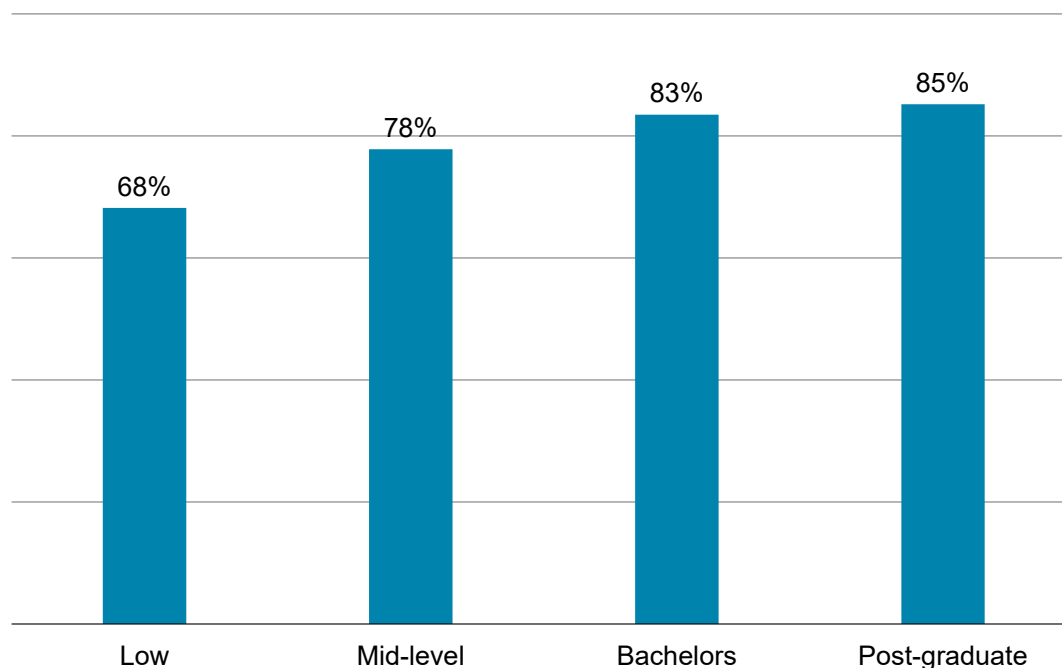
People with lower qualifications earn lower wages, but their lifetime income is further reduced because their participation in the labour market is lower. The opposite is true for those with the highest qualifications, where their high wage rates are reinforced by participating more in the labour market. For example, if those with post-graduate qualifications had the same labour market participation rate as those with low skills, their lifetime income would be roughly 80 percent of the actual level.

Many things drive labour market participation rates, including:

- social norms, particularly around child-rearing
- labour market access, including issues like sickness and disability
- the economic return from not working as opposed to working.

Most countries find that those with higher qualifications are more likely to be in the labour market. This is often attributed to their higher wages meaning they have a higher economic incentive to work (or a higher opportunity cost for not working). Their higher earnings may also enable them to overcome some barriers to working, including being able to afford more child-care and other household support.

**Figure 9: The labour market participation rate by qualification levels, 2018**



Source: Calculated from Le (2022)

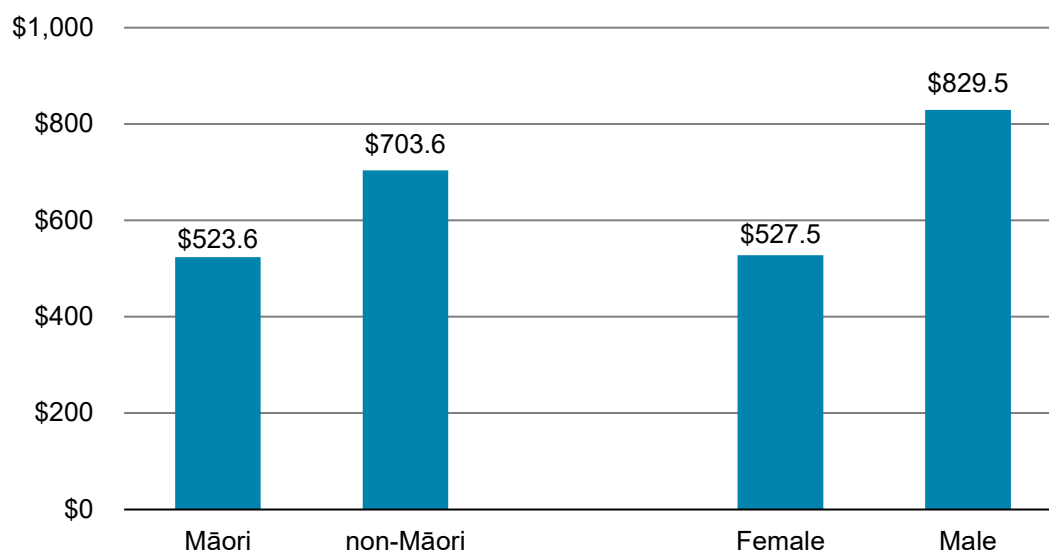
## 4 The differences between sub-groups

This section considers the trends in human capital for four sub-groups of the New Zealand population – men and women, and Māori and non-Māori. It provides some additional context for the variations between these sub-groups and also how the trends have varied across these sub-groups in our community.

The overall impact of these factors on average lifetime earnings is shown in Figure 10.

**Figure 10: Average per Capita Lifetime Labour Income, 2018**

In 2018 thousand dollars



Source: Le (2022)

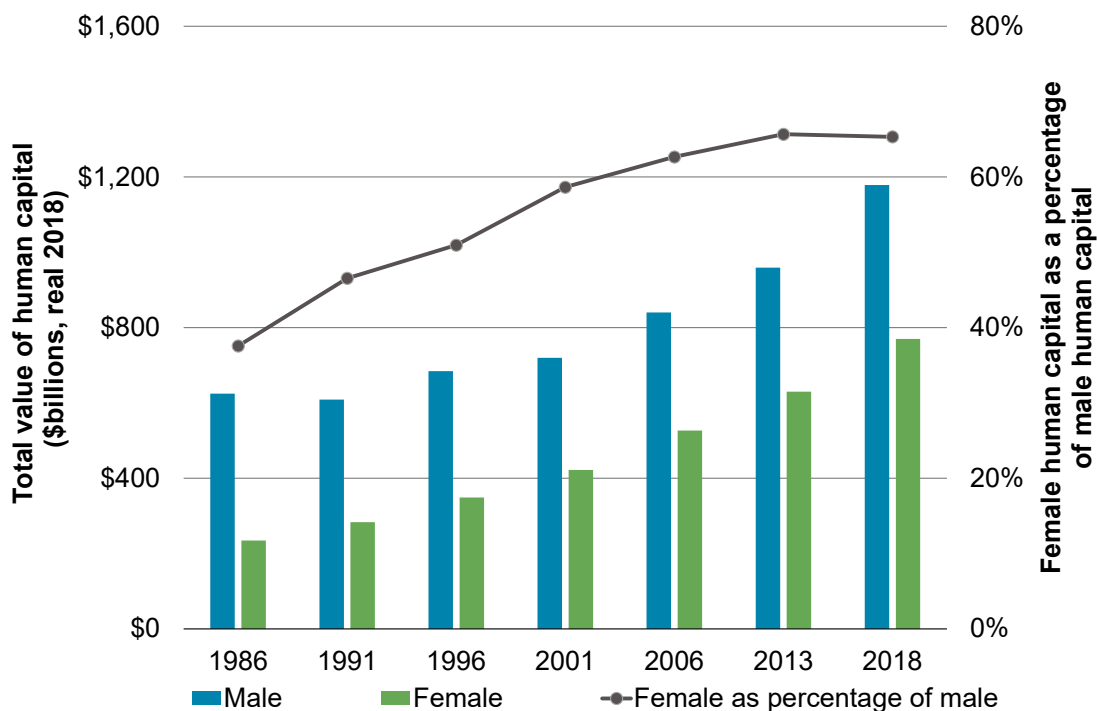
### Human capital by gender

The limitations of the focus on labour market returns are particularly highlighted when comparing women's and men's labour market outcomes. Women are more likely to be using their capabilities in activities that are not remunerated by the labour market, but which nevertheless have value to society. This shows in the human capital measures as lower labour market participation rates for women when they are in the childbearing age-groups. However, even though this analysis inevitably misses many aspects that are important, it does show some interesting trends over these three decades.

Since 1986 the labour market value of human capital has risen for both men and women, but the rate of growth has been faster for women, with the result that while women's human capital was 38 percent of men's in 1986, it was 65 percent in 2018 (Figure 11).



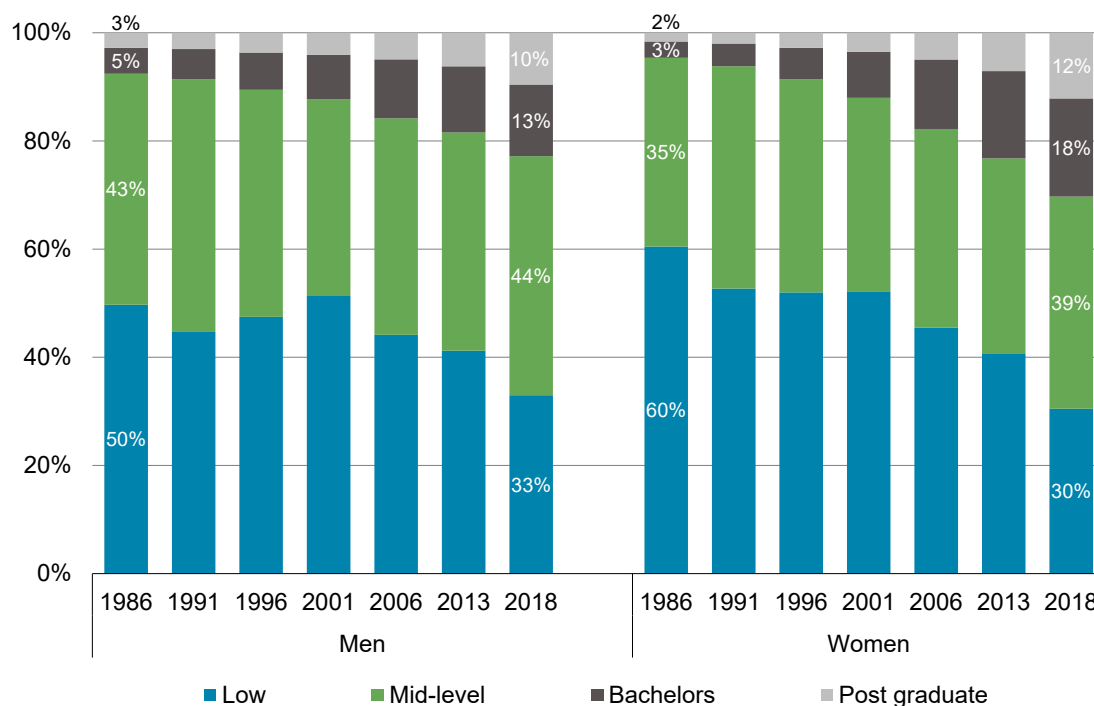
**Figure 11: The value of human capital, by gender, 1986 to 2018**



Source: Le (2022)

One reason for the faster growth of women’s human capital was that while both men and women have been gaining higher qualifications, women’s qualifications profile shifted more. In 1986 women had materially lower qualifications, but by 2018 they had a slightly higher skill profile than men, particularly with degree-level qualifications, where 23 percent of men had bachelors or post-graduate qualifications compared to 30 percent of women.

**Figure 12: The changing qualification mix for men and women, 1986-2018**



Calculated from: Le (2022)

The other reason for the relatively faster growth in women's human capital was the significant shift in their labour market participation. In 1986 57 percent of women were in the labour market while, in 2018, 72 percent were. Women disproportionately disengage from the labour market because of caregiving responsibilities. A complete valuation of human capability (going beyond human capital as defined here, as the present value of projected market earnings) would also capture the value of this unpaid work, but there is no yet agreed way of doing this, so it is not included in the methodology used for these figures.

## Māori and non-Māori human capital

The Treasury commissioned Trinh Le to produce, for the first time, a valuation of Māori human capital using the same methodology. This was done in the knowledge that Māori may frame the idea of human capital differently and identify more closely with the concepts set out in the He Ara Waiora framework.<sup>12</sup> Such conceptions might, for example, place higher emphasis on cultural capabilities and responsibilities.

Acknowledging these differing perspectives, extending this human capital analysis by comparing Māori and non-Māori enables a fuller understanding of some factors underpinning Māori wellbeing. Prior to this valuation, there was only information on the value of the physical and financial resources held in the Māori economy.

This analysis has been completed in the context where Government approaches to measurement are only now beginning to consider issues such as Māori data sovereignty – which holds that Māori data lies with Māori, regardless of who stewards the data – and te Tiriti-based data management.

The information on Māori used in the Trinh Le analysis comes from the censuses. People were identified as Māori if they identified as Māori in any of the relevant census questions. Individual people may change their declared Māori ethnic affiliation across time, and this may impact on the results.<sup>13</sup>

These new estimates showed that Māori projected lifetime income, on the basis of historical patterns, was significantly lower than non-Māori for all points in time for which the human capital estimates were calculated (Figure 13). As these numbers are intended to be a measure of the value of human capital available to the two ethnic groups, they are not adjusted for any of the differences between the Māori and non-Māori cohorts. These differences include age-structures (Māori have a younger population which would increase the value of their human capital as they have longer in the workforce) or qualifications levels. (Māori have lower qualifications, which would reduce the value of their human capital). The impact of qualification mix is discussed further below.

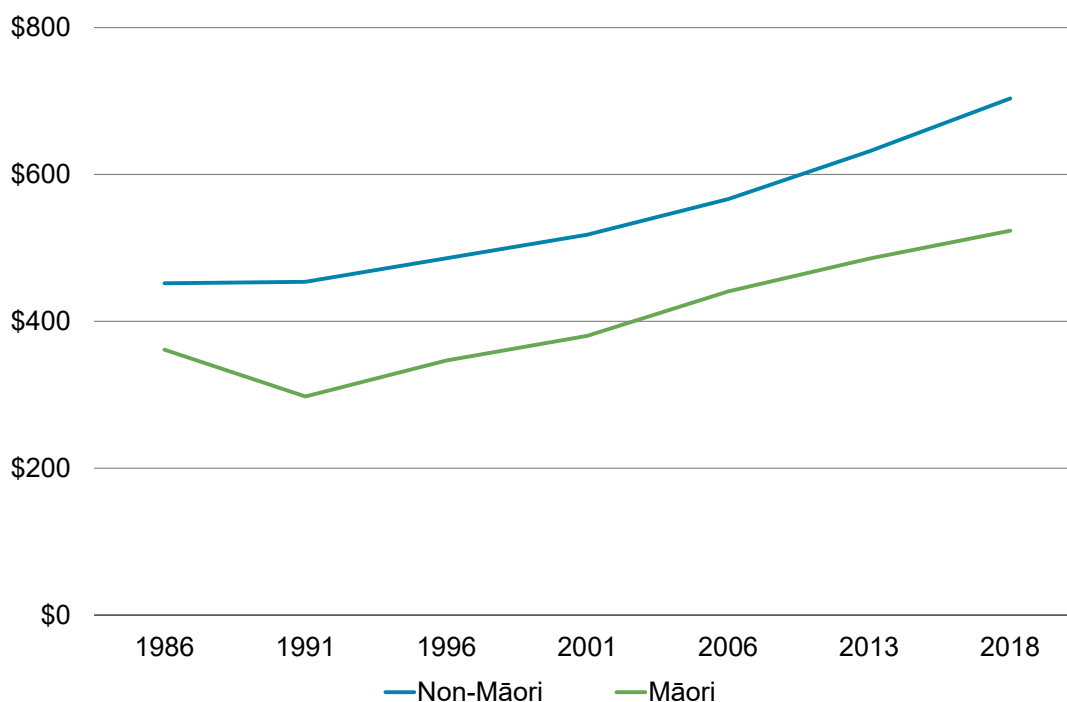
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<sup>12</sup> See the Background Paper on Trends in Māori Wellbeing for an analysis that refers to He Ara Waiora. Trends in Māori wellbeing (AP 22/02) (treasury.govt.nz).

<sup>13</sup> This varied from census to census so for details see Le, 2022.

**Figure 13: Estimated lifetime incomes, non-Māori and Māori**

Thousands, \$2018



Source: Le (2022)

Some additional factors are highlighted in analysis recently commissioned by the New Zealand Human Rights Commission on the factors that explained the variation in pay rates between different ethnic groups in the June 2019 and June 2020 Income Survey (Cochrane, 2022). This showed that in addition to the variations in qualifications and age, other job-related characteristics (occupation, industry, permanent and part-time status) were also important. In combination these factors explained 70 percent of the difference between Māori and New Zealand European in pay rates for men, and 73 percent for women, with job-related characteristics explaining the majority of this for Māori (Figure 14).

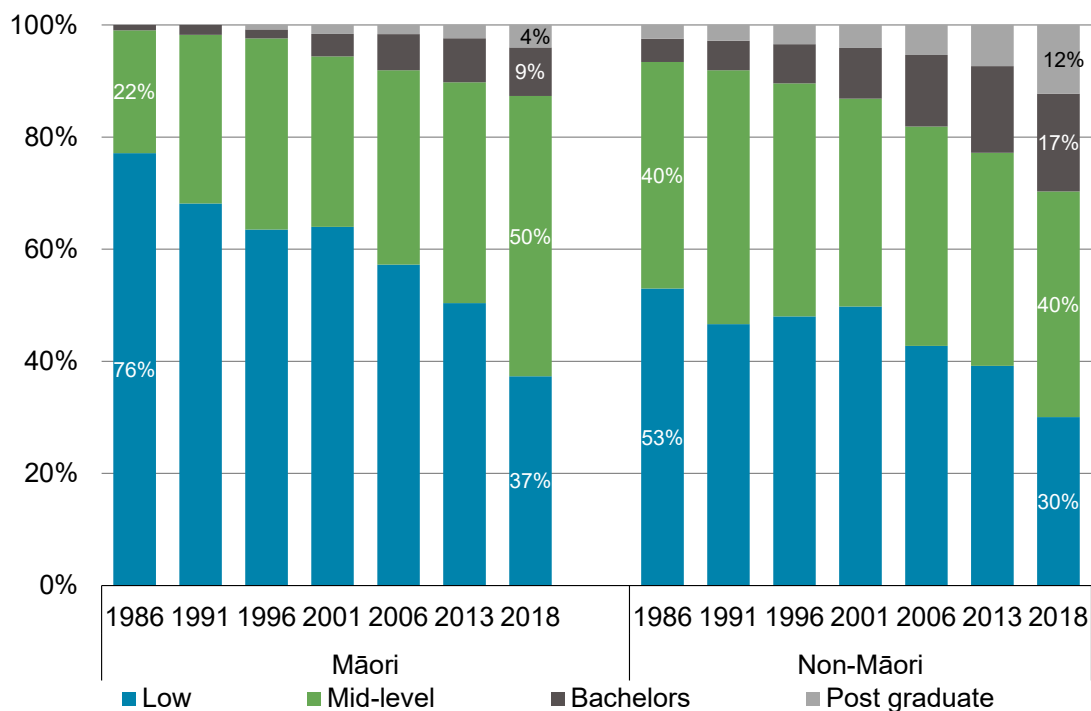
**Figure 14: Decomposition of the factors behind differences in the average pay rate**

Variable	Māori	
	Male	Female
Hourly pay difference (%)	19.03	11.71
Explained (% of difference)	70.37***	72.77***
<b>Explained</b>		
Individual	27.77***	13.95***
Education	14.98***	35.52***
Region	5.92*	6.42***
Job-related	51.33***	44.11***
Sample size	5,160	5,592

Source: (Cochrane 2022) Table 4

In the new analysis we commissioned from Le, both qualification mix and labour market participation were important in explaining the long-term trends in lifetime incomes. In terms of qualifications, in 1986 over three-quarters of Māori had low qualifications while only half of non-Māori did. By 2018 the two groups look much more similar in terms of low qualifications, but while the proportion of Māori with degree-level qualifications had risen to 13 percent, it was still below the non-Māori rate of almost 30 percent.

**Figure 15: Skill profiles of Māori and non-Māori, 1986-2018**



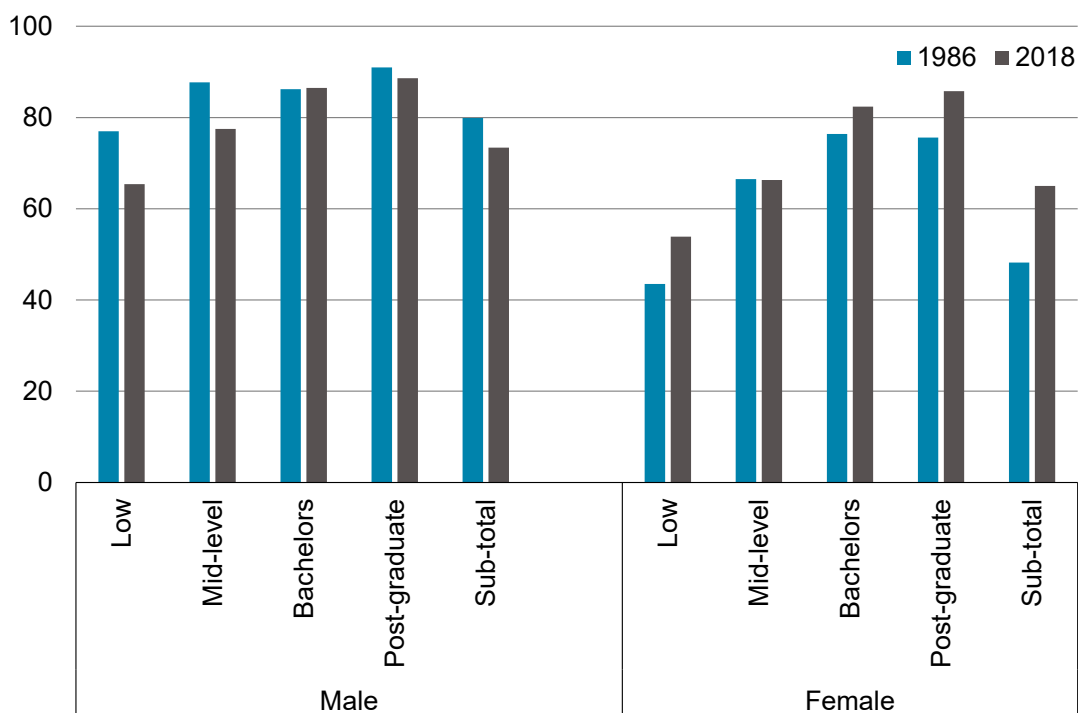
Source: Le (2022)

The second reason for the lower valuation of Māori human capital is a difference in the labour market participation rate which was 13 percent lower for Māori in 2018. This is due to lower labour market participation by Māori with low and mid-level skills, as those with bachelors and post-graduate degrees have a very slightly higher participation rate than non-Māori.

Māori labour market participation declined significantly between 1986 and 1991 and it only returned to its 1986 level in 2006. Since then, it has continued to rise, but this has been driven by rising female market participation. Male Māori labour market participation rates continue to be below the 1986 level, due to low participation rates for those with low and mid-level skills (Figure 16).

Overall, participation rates for Māori with low and mid-skills are lower than for non-Māori with the same skill level. However, this is not the case for the two higher skill categories (Figure 17).

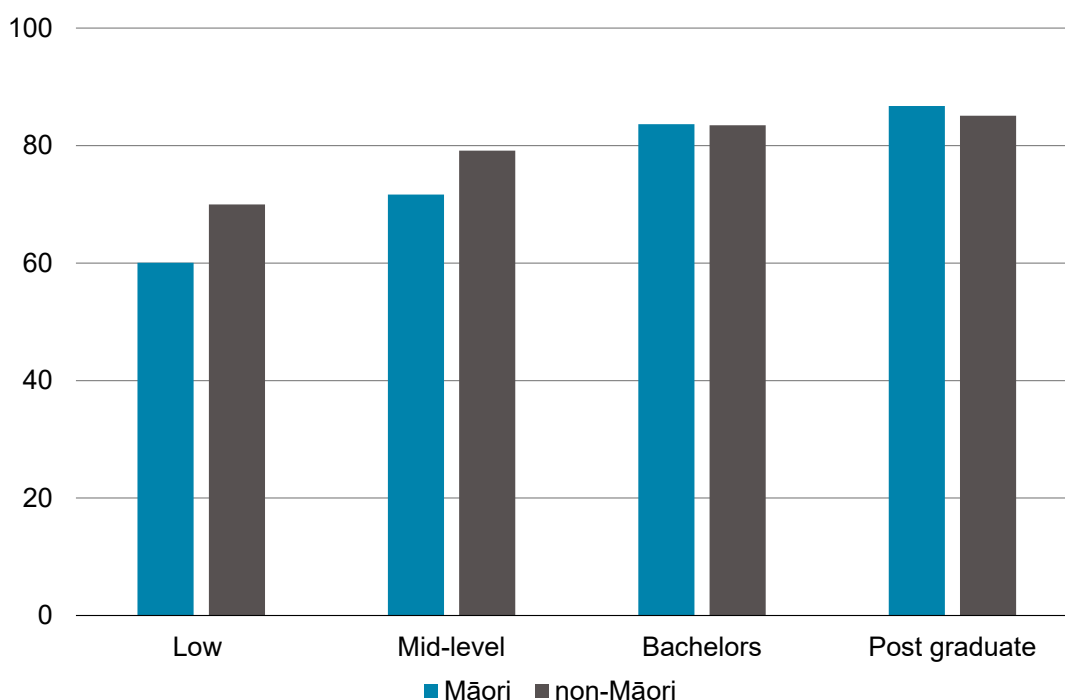
**Figure 16: Māori male and female participation rates by qualification, 1986 and 2018**



Source: Le (2022)

**Figure 17: Māori and non-Māori labour market participation rates in 2018**

Percentage of population in the labour force

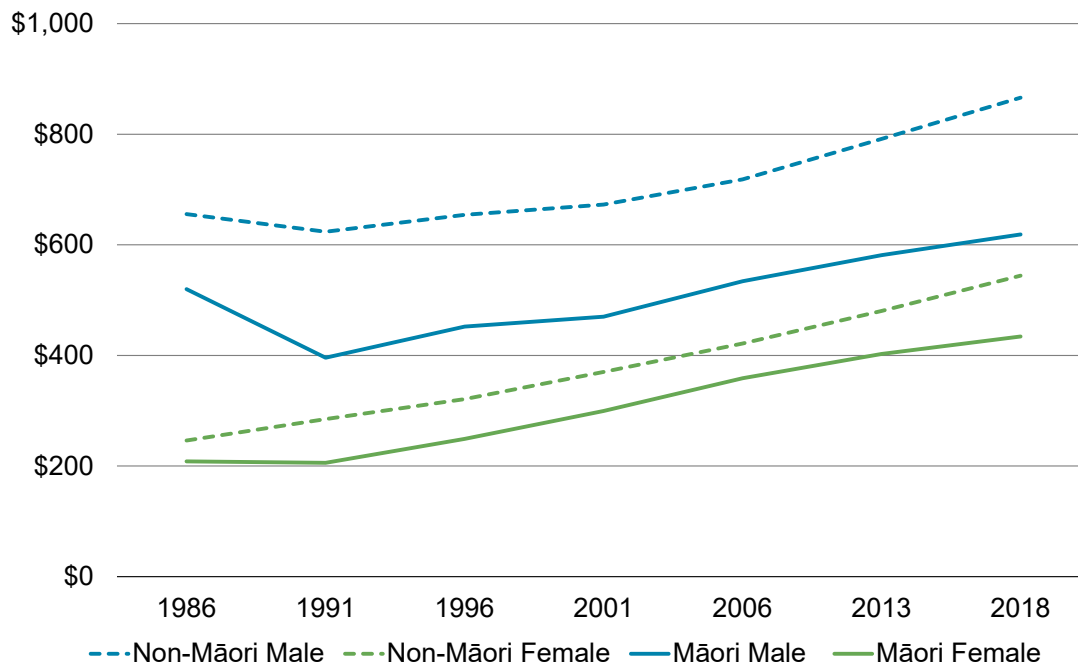


Source: Le (2022)

Both Māori and non-Māori lifetime incomes have been rising as labour market participation and qualification rates rose. While the ethnicity difference for women is relatively small, the difference in both the mix of qualifications and participation rates has meant that there continues to be a significant difference between Māori and non-Māori men's lifetime incomes.

**Figure 18: Lifetime incomes for Māori and non-Māori men and women**

Thousands \$2018

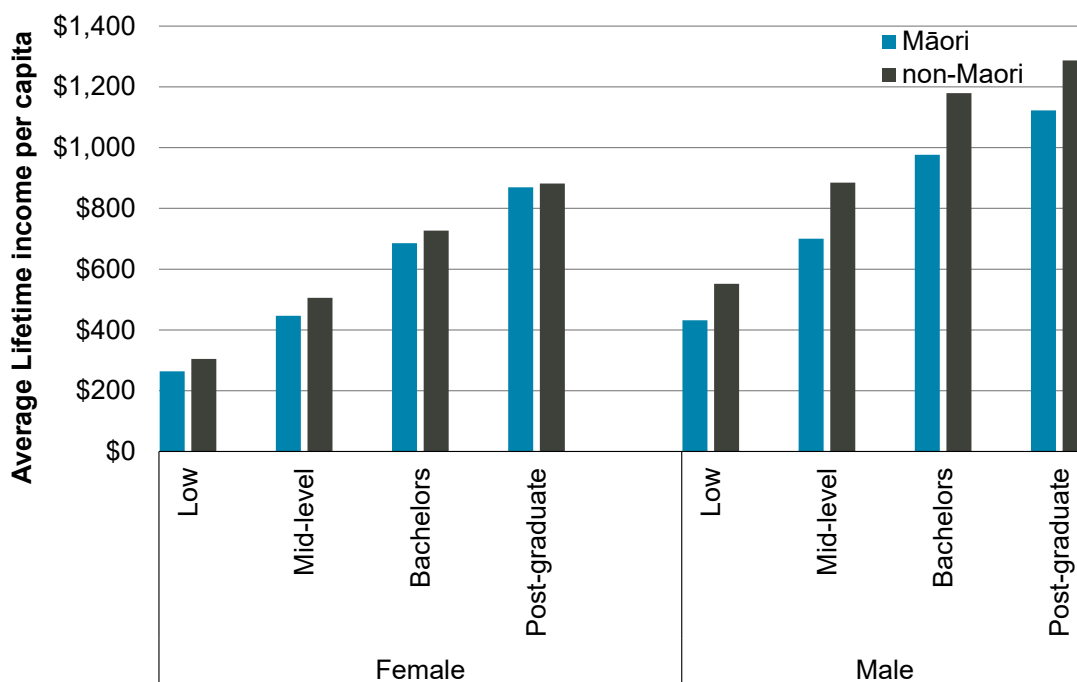


Source: Le (2022)

This reflects the fact that the difference in labour market participation rates by each qualification group is far higher for men than for women. Māori men with all levels of qualifications have a lower participation rate in the labour market, but Māori women’s participation rate is much closer to that for non-Māori women.

**Figure 19: Lifetime income by Māori ethnicity and gender, 2018**

\$2018 thousands

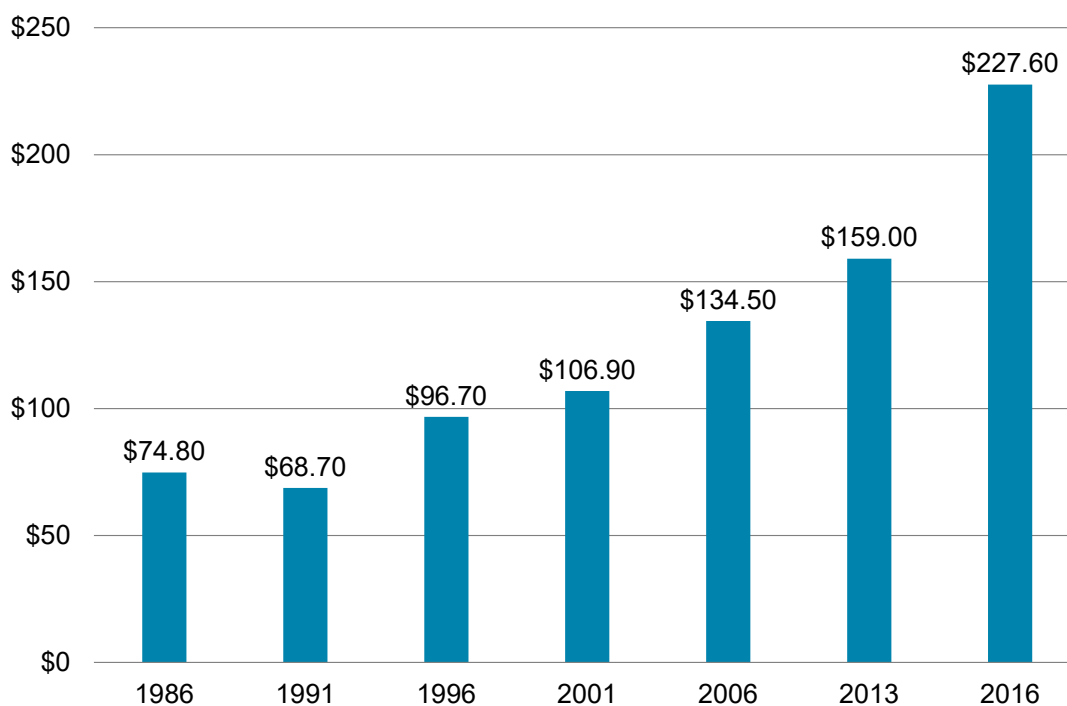


Calculated from Le (2022)

## The aggregate value of Māori human capital

We now have estimates for the total stock of Māori human capital from 1986 to 2018. These show that the total stock has increased faster than lifetime incomes because the proportion of the population that is Māori has also been increasing. All of this growth has occurred since 1991, and now in real terms, the total value of Māori human capital was in 2018 over three times the 1991 value.

**Figure 20: The aggregate value of Māori human capital, 1986 to 2018**



Source: Le (2022)

The only estimates of the produced capital in the Māori economy for 2013 and 2018 are by BERL, who summarised the key facts about the Māori economy including calculating the Māori GDP and capital stock for 2013 and 2018 (BERL, 2021). As with the total New Zealand economy, human capital is a significant resource underpinning current and future wellbeing, and as with the overall economy, it has a greater valuation than the Māori physical and financial capital stock (Égert et al, 2022).

**Table 3: Māori human and physical capital stocks, 2013 and 2018**

	Total New Zealand		Māori	
	2013	2018	2013	2018
Human capital	\$1589.3	\$1948.4	\$159.0	\$227.6
Capital stock	\$735.2	\$844.4	\$48.3	\$68.7

Sources: Māori: (BERL, 2021) Māori Capital p.19 and 20 and GDP p.36. The 2013 numbers have been inflated to 2018 using their reported GDP deflator value. Human capital (Le,2022); Total population: as for Table 2.

## 6 Next steps

This note is a short explanation of the methodology used to calculate the human capital metrics used in Te Tai Waiora. It also covers some of the interesting facts revealed by these calculations.

The valuation of human capital was used in the Te Tai Waiora to supplement the World Bank valuation of the comprehensive wealth of New Zealand. This report concluded that the increase in human capital strengthened the sustainability of wellbeing into the future.

The analysis even of this methodology is necessarily partial and high level. It would be useful to have a more robust shift-share analysis of the contribution of the different underpinning shifts to the overall changes in human capital. This would provide a better understanding of the relative importance of labour market participation, qualification mix, age and gender in the human capital trends.

More importantly, it would be highly desirable to move beyond the narrow labour market approach to incorporating the many non-labour market contributions of human capability to New Zealand's economic performance and to our broader wellbeing. This requires a significant improvement in the methodology for measuring these aspects of human capability.



## References

- Abraham, K & Mallatt, J. 2022. "Measuring human capital." *Journal of Economic Perspectives* 103-130. <https://pubs.aeaweb.org/doi/pdfplus/10.1257/jep.36.3.103>.
- BERL. 2021. "Te Ōhanga Māori 2018." <https://berl.co.nz/sites/default/files/2021-01/Te%20%C5%8Changa%20M%C4%81ori%202018.pdf>.
- Cochrane, B. & Pacheco, G. 2022. *Empirical analysis of Pacific, Maori and ethnic pay gaps in New Zealand*. Auckland: NZ Work Research Institute. <https://76v71b.p3cdn1.secureserver.net/wp-content/uploads/2022/07/PPG-Inquiry-Empirical-analysis-of-Pacific-Maori-and-ethnic-pay-gaps-in-New-Zealand.pdf>.
- Dasgupta, P. 2021. *The economics of biodiversity: the Dasgupta review*. HM Treasury. [https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment\\_data/file/962785/The\\_Economics\\_of\\_Biodiversity\\_The\\_Dasgupta\\_Review\\_Full\\_Report.pdf](https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/962785/The_Economics_of_Biodiversity_The_Dasgupta_Review_Full_Report.pdf).
- Deming, D. 2022. "Four facts about human capital." *Journal of Economic Perspectives* 75-102. <https://pubs.aeaweb.org/doi/pdfplus/10.1257/jep.36.3.75>.
- Égert, B., C. de la Maisonnette and D. Turner. 2022. "A new macroeconomic measure of human capital exploiting PISA and PIAAC-linked education policies to productivity." *OECD Economics Department Working Papers No 1709* (OECD Publishing). doi:<https://doi.org/10.1787/a1046e2e-en>.
- Hardy, W., Lewandowski, P., Park, A., and Yang, D. 2018. "The global distribution of routine and non-routine work." *ibs working paper 05/2018*. [https://conference.iza.org/conference\\_files/WoLabConf\\_2018/lewandowski\\_p9882.pdf](https://conference.iza.org/conference_files/WoLabConf_2018/lewandowski_p9882.pdf).
- Janssen, J. 2022. "New Zealand's Productivity Performance: Taking a Broader View." *Treasury Analytical Note 22/05*. <https://www.treasury.govt.nz/sites/default/files/2022-09/an22-05.pdf>.
- Janssen, J., Galt, M., and Bollinger, G. 2022. "New Zealand's productivity performance: Taking a broader view." *Treasury Analytical Note 22/05*. <https://www.treasury.govt.nz/sites/default/files/2022-09/an22-05.pdf>.
- Le, T., Gibson, J., & Oxley, L. 2006. "A forward-looking measure of the stock of human capital in New Zealand." *Manchester School*. doi:<https://doi.org/10.1111/j.1467-9957.2006.00511.x>.
- Le, Trinh. 2022. *Estimates of human capital for New Zealand 1986-2018 by ethnicity group*. . Unpublished work commissioned by the Treasury.
- Mare, D., Le, T., Fabling, R., and Chappell, N. 2017. "Productivity and the allocation of skills." *Motu Working Paper 17-04*. [https://motu-www.motu.org.nz/wpapers/17\\_04.pdf](https://motu-www.motu.org.nz/wpapers/17_04.pdf).

- Ministry of Education and Ministry of Business, Innovation & Employment. 2016. "Skills at work." Ministry of Education and Ministry of Business, Innovation & Employment, Wellington.  
[https://www.educationcounts.govt.nz/\\_\\_data/assets/pdf\\_file/0007/173572/Skills-at-Work.pdf](https://www.educationcounts.govt.nz/__data/assets/pdf_file/0007/173572/Skills-at-Work.pdf).
- Ministry of Education. 2016. "Skills in New Zealand and around the world: Survey of adult skills (PIAAC)."  
[https://www.educationcounts.govt.nz/\\_\\_data/assets/pdf\\_file/0003/173514/Skills-in-New-Zealand-and-Around-the-World.pdf](https://www.educationcounts.govt.nz/__data/assets/pdf_file/0003/173514/Skills-in-New-Zealand-and-Around-the-World.pdf).
- Morrissey, S. 2018. "The start of a conversation on the value of New Zealand's human capital." *Living Standards series: Discussion paper 18/02*.  
<https://www.treasury.govt.nz/sites/default/files/2018-02/dp18-02.pdf>.
- OECD. 2011. "Measuring the stock of human capital for comparative analysis: An application of the lifetime income approach to selected countries." *Statistics Directorate Working Paper no 41* (2011). doi:<https://doi.org/10.1787/18152031>.
- Satherley, P. March 2022. *Education and political efficacy*.  
[https://www.educationcounts.govt.nz/\\_\\_data/assets/pdf\\_file/0020/213464/education-and-political-efficacy-report-final.pdf](https://www.educationcounts.govt.nz/__data/assets/pdf_file/0020/213464/education-and-political-efficacy-report-final.pdf): Ministry of Education.
- Satherley, P. Dec 2021. *Education and two social trust indicators*.  
[https://www.educationcounts.govt.nz/\\_\\_data/assets/pdf\\_file/0009/210042/Education-and-two-social-trust-indicators.pdf](https://www.educationcounts.govt.nz/__data/assets/pdf_file/0009/210042/Education-and-two-social-trust-indicators.pdf): Ministry of Education.
- Satherley, P. Sept 2022. *Education and Volunteering*.  
[https://www.educationcounts.govt.nz/\\_\\_data/assets/pdf\\_file/0016/216502/Education-and-volunteering.pdf](https://www.educationcounts.govt.nz/__data/assets/pdf_file/0016/216502/Education-and-volunteering.pdf): Ministry of Education.
- Scott, D. Jan 2021. *Education and health*.  
[https://www.educationcounts.govt.nz/\\_\\_data/assets/pdf\\_file/0016/206026/education-and-health-report.pdf](https://www.educationcounts.govt.nz/__data/assets/pdf_file/0016/206026/education-and-health-report.pdf): Ministry of Education.
- Statistics New Zealand. 2022. *Household Labour Force Survey*. June.  
<https://www.stats.govt.nz/information-releases/household-labour-force-survey-estimated-working-age-population-june-2022-quarter/>.
- The Treasury. 2022. *Te Tai Waiora Wellbeing in Aotearoa New Zealand 2022*.  
<https://www.treasury.govt.nz/publications/wellbeing-report/te-tai-waiora-2022>.
- The Treasury. 2022a. "New Zealand's wellbeing: Is it sustainable and what are the risks? Background Paper for the 2022 Wellbeing Report."  
<https://www.treasury.govt.nz/publications/tp/new-zealands-wellbeing-sustainable-what-are-risks>.
- World Bank. 2021. *The changing wealth of nations 2021: Managing assets for the future*. World Bank. Changing Wealth of Nations (CWON) ([worldbank.org](http://worldbank.org)).

# Appendix 1

## Aggregate Value of Human Capital Stock, in 2018 billion dollars, converted using the Labour Cost Index All Salary & Wage Rates

Qualification level	1986	1991	1996	2001	2006	2013	2018
Male							
Unskilled*	241.7	187.7	212.0	237.0	234.3	226.8	247.9
Non-degree**	301.3	324.2	339.5	327.7	392.3	441.3	535.9
Bachelors	50.0	62.4	86.0	101.8	145.1	190.5	219.5
Postgraduate	31.4	34.4	46.7	53.0	68.4	100.6	175.4
<b>Sub-total</b>	<b>624.4</b>	<b>608.6</b>	<b>684.2</b>	<b>719.5</b>	<b>840.0</b>	<b>959.3</b>	<b>1178.5</b>
Female							
Unskilled*	100.0	93.3	110.0	125.9	132.6	129.7	127.5
Non-degree**	110.8	152.2	177.0	197.3	227.6	247.9	284.1
Bachelors	14.6	24.8	40.9	66.6	115.2	165.9	198.7
Postgraduate	9.1	13.0	20.6	32.1	51.0	86.5	159.6
<b>Sub-total</b>	<b>234.5</b>	<b>283.3</b>	<b>348.6</b>	<b>422.0</b>	<b>526.4</b>	<b>630.0</b>	<b>769.9</b>
<b>Total</b>	<b>\$858.9</b>	<b>\$892.0</b>	<b>\$1032.8</b>	<b>\$1141.5</b>	<b>\$1366.5</b>	<b>\$1589.3</b>	<b>\$1948.4</b>
Change from last census		3.9	15.8	10.5	19.7	16.3	22.6
Annual growth rate from last census		0.8%	3.0%	2.0%	3.7%	2.2%	4.2%

Source: Le (2022)

The full results, and details of the methodology, are available as a spreadsheet.